PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventors: GORDON FRANK LEITNER and RICHARD WARREN GOELDNER

901,077

Date of Application and filing Complete Specification July 15, 1960.

No. 24705/60.

Complete Specification Published July 11, 1962.

Index at acceptance:—Class 32, B(3D1:4A:5J).

International Classification:—**B01d.**

COMPLETE SPECIFICATION

Evaporator

PATENTS ACT, 1949

SPECIFICATION NO. 901,077

In accordance with the Decision of the Superintending Examiner, acting for the Comptroller-General, dated the 19th day of February, 1964, this Specification has been amended under Section 14 in the following manner:-

Page 1, line 52, Page 2, line 121, *after* "shell", *insert* "said longitudinal wall including insulating means for insulation between chambers on opposite sides of the shell",

also, Reference has been directed in pursuance of Section 9, subsection(1) of the Patents Act, 1949 to patent No. 855,550.

THE PATENT OFFICE,
20th April, 1964

D 4444/1(2)/R.109 200 4/64 PL

ERRATUM

SPECIFICATION No. 901,077

Page 2, line 83, *after* "fresh" *read* "sea"

THE PATENT OFFICE
16th February 1965

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[*Price* ... ...]

PATENT SPECIFICATION

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901077

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COMPLETE SPECIFICATION

Evaporator

We, AQUA-CHEM, INC., formerly known as Cleaver Brooks Special Products, Inc., a corporation organized under the laws of the State of Wisconsin, United States of America, of 225, North Grand Avenue, Waukesha, Wisconsin, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an evaporator and more particularly to a multiple stage flash evaporator for water distillation.

It is the general object of the present invention to produce a new and improved evaporator of the character described.

It is a more specific object of the invention to produce a flash evaporator of the multiple stage type which is so constructed and arranged to be efficient and compact and yet economical to manufacture.

A more specific object of the invention is to provide an evaporator of the character described in the preceding paragraphs wherein an elongated generally cylindrical casing may be divided into a plurality of flash chambers by means of a single longitudinal wall and a plurality of transverse partitions, thereby providing an evaporator in which the heat losses can be reduced to the minimum, fabrication is simplified, and more efficient operation will result.

Yet a further object of the invention is to produce a flash evaporator of the type described in the preceding paragraph wherein said longitudinal wall is insulating in character so as to permit the first and last stages of the evaporator to be at the same end of the elongated casing thereby furthering the economies of manufacture.

According to the present invention there is provided a flash evaporator for water distillation comprising an elongated shell, a plurality of transverse partitions dividing the shell into a plurality of transverse sections, a central, vertical, longitudinal wall extending substantially from end to end of the shell and dividing the sections into a first series of flash chambers extending along one side of the shell and a second series of flash chambers extending along the other side of the shell, means in each chamber for condensing the flashed vapors and for withdrawing condensate therefrom, and means for passing the water progressively through the first series of chambers and then through the second series of chambers, a feed water inlet opening into the first chamber of the first series of chambers and a feed water outlet opening into the last chamber of the second series of chambers, said first and last chambers being defined by a common partition and separated by said wall.

The invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a top plan view of a distilling apparatus embodying the invention;

Figure 2 is an enlarged vertical section along the line 2—2 of Figure 1; and

Figure 3 is an enlarged vertical section taken along the line 3—3 of Figure 2.

Referring now to Figure 1 of the drawings, there is shown an evaporator apparatus including a generally cylindrical elongated shell 10 divided by transverse partitions 11*a*, 11*b*, 11*c* and 11*n*, into a plurality of transverse sections defined between the partitions.

A central, vertical, generally longitudinally extending wall indicated generally as 12 divides each of the sections into flash chambers, there being a first series of flash chambers 13*a*, 13*b*, 13*c*, 13*d* and 13*n*, extending along one side of the shell, and a second series of flash chambers 14*a*, 14*b*, 14*c*, 14*d* and 14*n* extend-

[*Price* 4*s*. 6*d*.]

ing along the other side of the shell. End walls 15 and 16 form closures for the end of the shell and are utilized in a manner hereinafter described for providing feed water flow connections.

As clearly shown in Figures 2 and 3, each of the partitions is provided with an opening 17 adjacent the bottom of the shell so as to establish communication between the flash chambers in each series of flash chambers, and means (described hereafter) are provided to maintain a liquid or loop seal between the chambers of each section. As seen in Figure 3, extending across the bottom of each flash chamber is a weir 18 having a height greater than the top of the adjacent opening 17. A perforated plate 19 extends horizontally across but spaced from the bottom of each flash chamber and connects at one end to the adjacent partition and at the other end to the top of the weir.

In each flash chamber there is provided a plurality of inverted channels 20 extending across the top of the chamber to prevent water splashing upwardly above the perforated plate 19 from reaching the demister 21. Vapors flashed in each flash chamber after passing through the demister are condensed on the condenser tube bundle 22 and fall into a condensate trough 23 from which they may be drawn through the distillate outlet 24.

In operation, as applied to sea water distillation, fresh salt water is passed by a pump (not shown) into a large conduit (not shown) from whence it passes into the condenser tubes in the flash chamber stage 14*a*, thence lineally through condenser tubes extending from end to end of the shell and sequentially through flash chambers 14*b*, 14*c*, 14*d* and eventually to chamber 14*n*. Leaving the condenser tubes in chamber 14*n* the sea water is passed by means of conduit 26 into the condenser tubes in the flash chamber 13*n* and then sequentially (and in the same manner as the passage through the 14 series) through the condenser tubes in the flash chambers 13*d*, 13*c*, 13*b* and 13*a*. The sea water, warmed by the passage through the condenser tubes in the chambers, is then directed by means of a pipe 27 into a feed water heater 28 from which it is discharged through pipe 29 into a feed water inlet 30 which is located beneath the perforated plate 19 in the first stage 13*a* of the first series of flash chambers. The hot feed water passes upwardly through the perforations in the plate 19 in the flash chamber 13*a* and a portion thereof flashes into vapor within the chamber, which vapor is condensed and withdrawn in the manner previously described. Unflashed sea water passes over the weir 18 downwardly through the opening 17 and emerges beneath the perforated plate 19 in the chamber 13*b*, the next lower chamber of the series. Unflashed sea water passing out of the chamber 13*n* is directed by suitable piping (not shown) into the chamber 14*n* and then passes sequentially to the last chamber of the last series 14*a*. A suitable feed water outlet 31 directs the feed water into a discharge line 32 for discharge overboard.

Preferably, there are at least ten flash chambers in each series, thus making a total of at least twenty chambers, and as many as thirty or forty may be provided.

It will be noted that the first chamber in the first series, that is the chamber 13*a*, is separated from the last chamber in the last series, chamber 14*a*, by the longitudinal wall 12. It will be clear that the feed water from which the vapors are to be flashed is at its highest temperature in the chamber 13*a* and at its lowest temperature in the chamber 14*a*, while on the other hand the incoming fresh water directed into the condenser tubes is at its coolest temperature in the chamber 14*a* and at its highest temperature in the chamber 13*a*. To maintain the temperature differentials just stated which are required for the operation of the apparatus, the wall 12 is of insulating construction and thus acts to prevent or materially reduce the exchange of heat between chambers on opposite sides of the shell. In the particular embodiment chosen for illustration, the wall 12 is made up of two wall portions 12*a* and 12*b* which are separated by a space 12*c*. The space 12*c* may be provided with insulating material such as fiberglass if desired, although normally this is not necessary.

The economies of making an evaporator which is primarily a single elongated and, preferably, cylindrical shell divided into the required number of flash chambers by simple partitioning, will be readily apparent to those skilled in this particular art. Furthermore, the utilization of the lineal tubes in the condenser bundles which extend without a reverse and from end to end of each series of flash chambers also reduces the expense of manufacturing and increases the efficiency of operation.

WHAT WE CLAIM IS:—

1. A flash evaporator for water distillation comprising an elongated shell, a plurality of transverse partitions dividing the shell into a plurality of transverse sections, a central, vertical, longitudinal wall extending substantially from end to end of the shell and dividing the sections into a first series of flash chambers extending along one side of the shell and a second series of flash chambers extending along the other side of the shell, means in each chamber for condensing the flashed vapors and for withdrawing condensate therefrom, and means for passing the water progressively through the first series of chambers and then through the second series of chambers, a feed water inlet opening into the first chamber of the first series of chambers and a feed water outlet opening into the last chamber of the second series of chambers,

said first and last chambers being defined by a common partition and separated by said wall.

2. A flash evaporator according to Claim 1, wherein said wall comprises two wall portions which are spaced apart to provide substantial insulation between chambers on opposite sides of said shell.

3. A flash evaporator according to Claim 1, or 2, wherein there are sufficient partitions to form in said shell at least twenty chambers.

4. A flash evaporator according to Claim 1, 2 or 3, wherein each of said partitions is provided with two openings one adjacent the bottom of each flash chamber, and each flash chamber is provided with a weir extending above the said opening in the partition, each chamber in each series thereby being sealed from the next chamber in the series by said partition and by a feed water seal created by said weir.

5. A flash evaporator for water distillation substantially as herein described with reference to the accompanying drawings.

STEVENS, LANGNER, PARRY & ROLLINSON,
Chartered Patent Agents,
Agents for the Applicants.

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FIG1

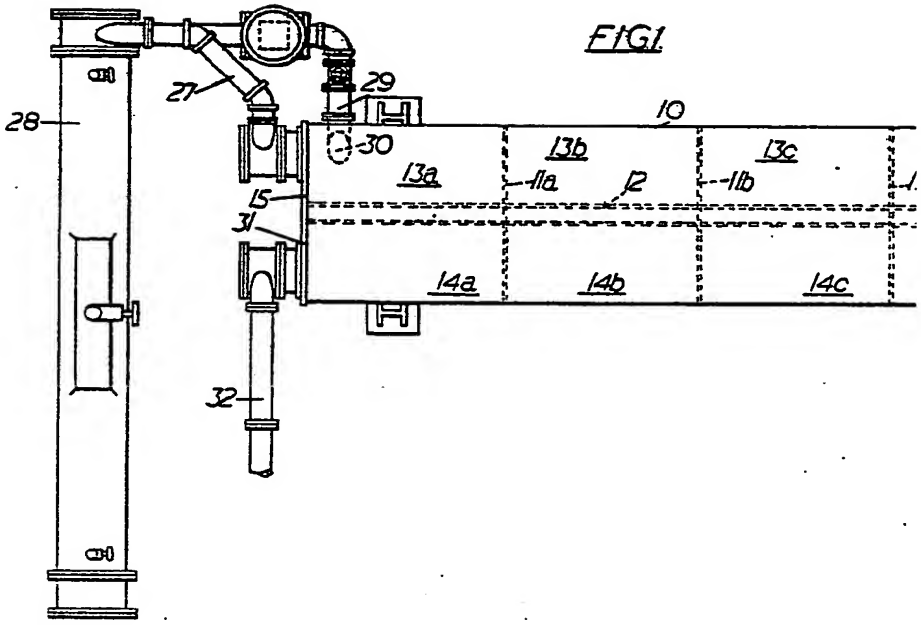
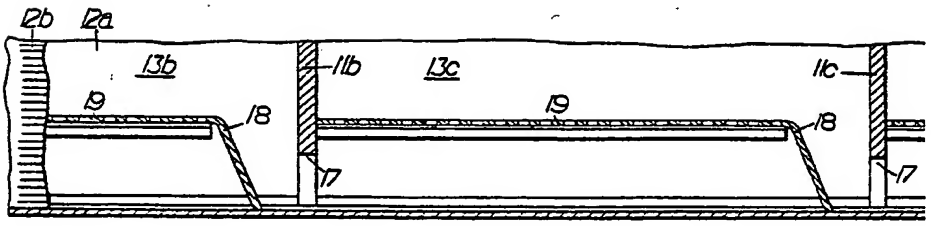

28
27
29
10
30
13a
13b
11a
12
13c
11b
15
31
14a
14b
14c
32

FIG.3.


12b
12a
13b
11b
13c
11c
19
18
19
18
17
17

901077 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

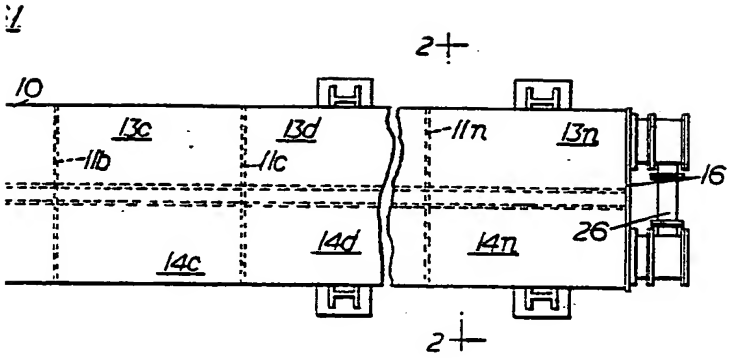
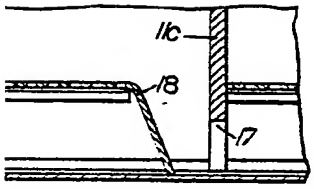
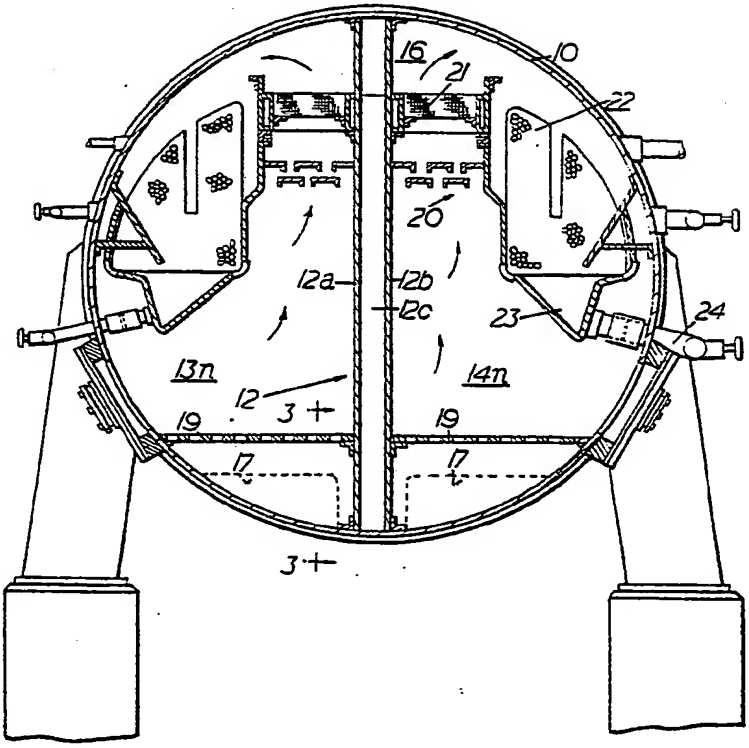


FIG.2.





501377 COMPLETE SPECIFICATION
1 SHEET This drawing is a reproduction of the Original on a reduced scale

FIG1

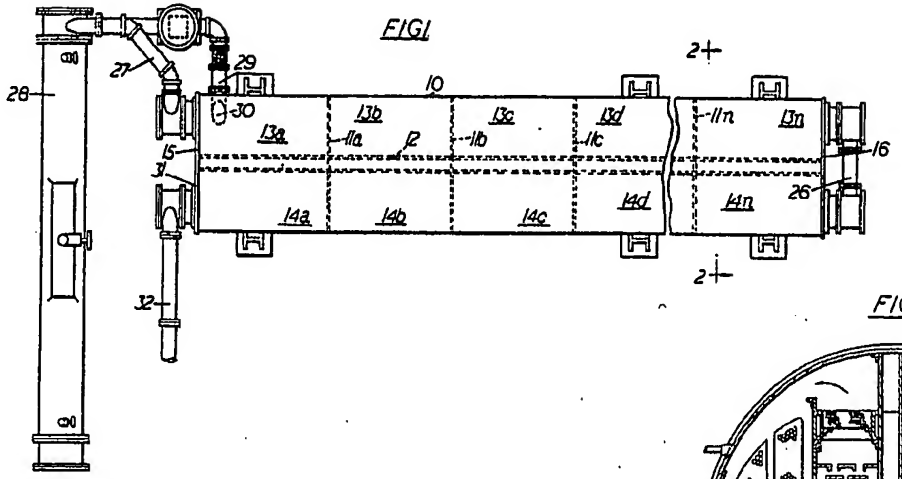


FIG2

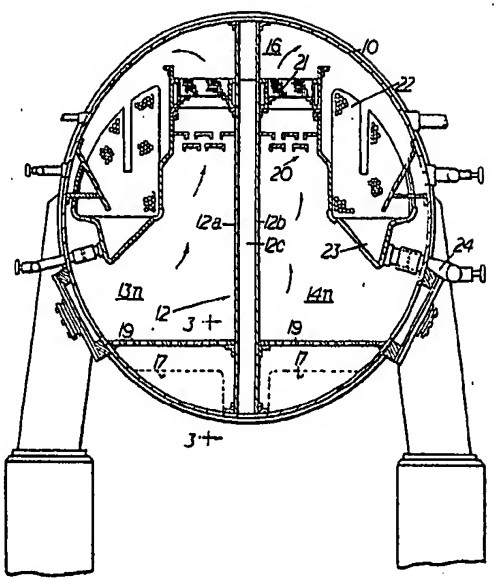


FIG3